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Evaluation of Freshwater Wetland Replacement Projects in Massachusetts

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This study evaluated the status of several completed replacement wetlands. The goals were to: 1) evaluate success of replacement wetlands, 2) determine vegetation growing in replacement areas, and 3) make recommendations for conditioning of wetland projects. One hundred projects of wetland replacement were compiled from a database. 76 of 100 projects have been completed with 94 replacement wetlands present at the 76 project sites. The replacement wetlands must 1) have 75% cover of indigenous wetland species and 2) have a surface area equal to the area of wetland lost. 57% of the 94 completed areas are successful. Of the 31 projects granted Certificates of Compliance (COC), 1 out of 10 existing replacement wetlands were found to be unsuccessful. In three additional projects, replacement wetlands were destroyed. Unsuccessful replacement wetlands failed due to inadequate site preparation.

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EVALUATION OF FRESHWATER WETLAND REPLACEMENT PROJECTS IN MASSACHUSETTS

prepared for

State of Massachusetts

by

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

December 1989

EXECUTIVE SUMMARY

Under Massachusetts Wetlands Protection Act Regulations (310 CMR) local authorities or the Department of Environmental Protection (DEP) can require the construction of "replacement" wetlands to compensate for destruction or degradation of bordering vegetated wetlands. Although numerous wetland replacement projects have been authorized in Massachusetts, little quantitative information is available regarding the success of these projects. This study was conducted to evaluate the status of a large number of completed replacement wetlands. The primary goals were to 1) evaluate the general success of the replacement wetlands, 2) determine the nature of vegetation growing in replacement areas, and 3) provide recommendations for conditioning of future wetland replacement projects.

One hundred projects were selected for study from a database of wetland replacement projects compiled by Tufts University, in conjunction with the Massachusetts Association of Conservation Commissions (MACC). The selected projects were located in 31 towns situated throughout Massachusetts. Contacts with Town Conservation Commissions indicated that 76 of the 100 projects had been completed, or were well underway. For each of these projects, the Notice of Intent (NOI), Order of Conditions (OOC), and any available wetland replacement plans were reviewed. Project sites were then visited to obtain information concerning the status of the replacement wetlands. A total of 94 replacement wetlands were present at the 76 project sites.

Evaluation of replacement wetlands was based primarily on two criteria set forth in CMR 10.55. These criteria require that replacement wetlands: 1) have 75 percent cover of indigenous wetland species, and 2) have a surface area equal to the area of the wetland lost.

Fifty seven percent of the 94 completed replacement areas were rated as successful or conditionally successful based on the above criteria. Thirty six percent of the remaining areas were rated as unsuccessful, and were in need of remedial engineering work.

Thirty one projects had been granted a Certificate of Compliance (COC) by Town Conservation Commissions. In ten of these projects, one or more existing replacement wetland was found to be unsuccessful according to the above criteria. In three additional projects, replacement wetlands had apparently been destroyed after the COC was granted.

Essentially all unsuccessful replacement wetlands appeared to fail because of inadequate site preparation. Finished elevations were frequently too high, resulting in a predominance of upland plant species. In some instances, sites were excavated too deeply, and the resulting wetlands were ponds that supported only a narrow fringe of emergent vegetation. About 50 percent of the unsuccessful replacement areas were of insufficient size to meet 1:1 replacement criteria. In many instances sites appeared to be too small because plans failed to account for area taken by the side slopes of the replacement wetlands.

Given a proper grade and soils, adequate herbaceous wetland vegetation appears almost certain to eventually develop in replacement areas. The widespread practice of placing 6 to 8 inches of organic soil from filled areas into replacement areas seems to provide an adequate substrate and propagules for establishing a diverse herbaceous community.

Although this study provided no clear evidence that forested or scrub-shrub wetlands can be successfully replaced, red maple seedlings were noted in about 40 percent of the replacement areas. The presence of red maple seedlings in many replacement wetlands is encouraging, and suggests that forested wetlands could eventually develop at these sites. Further studies are needed to monitor the survivorship and growth of red maple seedlings in replacement wetlands.

This study was not designed to address questions concerning the "functional" values of replacement wetlands versus those of the filled wetlands. Virtually all the successful replacement wetlands, however, were marshes or wet meadows dominated by herbaceous species. These wetlands may have substantially different functional values relative to the filled wetlands, most of which were forested or scrub-shrub wetlands. Wildlife habitat value, in particular, is likely to vary greatly between the filled and replacement wetlands. Further studies of the functional values of replacement versus natural wetlands are needed.

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INTRODUCTION

STUDY AUTHORITY

This study was conducted by the New England Division of the U.S. Army Corps of Engineers at the request of the Massachusetts Department of Environmental Protection. Authority for the study is contained in Section 22 of the 1974 Flood Control Act (Public Law 93-251) as amended ("Planning Assistance to States") which authorizes cooperation with the states in preparation of plans for the development, utilization, and conservation of water resources.

STUDY PURPOSE AND SCOPE

Under Massachusetts Wetlands Protection Act Regulations (310 CMR) local authorities or the Department of Environmental Protection (DEP) can require the construction of "replacement" wetlands to compensate for destruction or degradation of bordering vegetated wetlands. Bordering vegetated wetlands are defined as freshwater wetlands (i.e. wet meadows, marshes, swamps, and bogs) which border on creeks, rivers, streams, ponds, and lakes (see CMR 310.55). Replacement wetlands are required to meet a series of general performance standards (see Appendix A), and any other conditions deemed necessary to insure that they function similarly to the wetland that was lost (310 CMR 10.55).

Although numerous wetland replacement projects have been authorized in Massachusetts (Dobberteen, 1989), little quantitative information is available regarding the success of these projects in meeting performance standards. This study was conducted to evaluate the status of a large number of completed replacement wetlands. The primary goals of the study were to 1) evaluate the general success of the replacement wetlands, 2) determine the nature of vegetation growing in replacement areas, and 3) provide recommendations for conditioning of future wetland replacement projects.

STUDY DESIGN AND METHODS

PROJECT SELECTION

One hundred projects were selected for study from a database of Massachusetts wetland replacement projects compiled by Tufts University, in conjunction with the Massachusetts Association of Conservation Commissions (see Dobberteen, 1989). The database includes information obtained from 77 Conservation Commissions, and is thought to be a representative survey of wetlands permitting activity in Massachusetts.

Projects were selected for study from the database on a stratified random basis. The following strata were incorporated into the selection process:

1) Geographic location (DEP Region I,II,III or IV)

2) Size of replacement project (< 5000 square feet, 5000-10,000 square feet, > 10,000 square feet).

3) Type of existing (filled) wetland (i.e. marsh, swamp, wet meadow).

Projects in the data base with an Order of Conditions issued by Town Conservation Commissions after May of 1988 were not selected, since many of these sites may be under construction or not yet built.

Projects selected were located in 31 towns situated throughout Massachusetts (Table 1). Forty five projects were located in northeastern Massachusetts (DEP Region I), 23 in southeastern Massachusetts (Region II), 22 in central MA (Region III), and 10 in western Massachusetts (Region IV).

Information provided about the selected projects in the Tufts/MACC database is presented in Appendix B.

Table 1: Massachusetts Towns Included in This Study.

Ashburnham	Greenfield	Pittsfield
Barnstable	Hanson	Rehoboth
Barre	Harvard	Raynham
Belchertown	Littleton	Scituate
Braintree	Lincoln	Sterling
Brockton	Marion	Tewksbury
Carlisle	Milford	Wellesley
Easton	Millis	Wilmington
Eastham	North Andover	Williamstown
Essex	Norton	Worcester
Gardner		

REVIEW OF PROJECT FILES

For each project, information contained in Town Conservation Commission files (or in a few instances DEP files) was reviewed. Documents examined included the Notice of Intent (NOI), Order of Conditions (OOC), and any available wetland replacement plans. Additional information was frequently obtained from interviews with Town Conservation Administrators or Conservation Commission members.

Order of Conditions were reviewed for any specific conditions related to wetlands replacement plans.

Wetland replacement plans were reviewed for information concerning: 1) location, size, and number of proposed wetland replacement areas; 2) soils to be used in the replacement area(s); 3) vegetation to be planted in the replacement area(s); 4) the proposed grade; 5) the proposed construction sequence and work schedule; and 6) proposed monitoring and maintenance of the replacement wetland(s).

The general quality of replacement plans and Orders of Conditions were evaluated using criteria set forth in Table 2. In instances where the Orders of Conditions incorporated replication plans provided by the applicant, evaluation of the OOC included consideration of these plans.

FIELD OBSERVATIONS

All field work was conducted between late June and early August of 1989.

The following data was collected at each replacement area:

1) A list of plant species present and their relative abundance.

2) An estimate of wetland, non-wetland, and total vegetative cover in the replacement area. Separate estimates for herbaceous and woody percent cover were also recorded. "Wetland" species were defined as those recognized as facultative or obligate wetland indicators by the U.S. Fish and Wildlife Service (1988). Although many of these species are not specifically identified in the Massachusetts Wetland Protection Act, they may, nonetheless, be considered wetland species according to state policy (see Gaskell, 1985).

3) Percent cover of standing water and fill material.

4) Relation of the replacement wetland to other wetland habitats (i.e. contiguous, isolated, connected via a stream channel).

Table 2. Criteria Used to Evaluate Replacement Plans and Orders of Conditions.

Rank	Criteria
Replication Plans	
1)	Plans provide little or no specific information concerning construction of the replacement wetland. Frequently only engineering plans showing wetland location and size are provided.
2)	Plans provide more detailed information concerning construction techniques, including some information about site preparation and planting material.
3)	Plans provide information concerning construction techniques, and provisions for monitoring and/or maintenance of the replacement wetland.
Order of Conditions	
1)	OOC includes no or only minimal specific conditions regarding wetlands replacement.
2)	Some specific instructions concerning wetlands replacement are included in OOC (i.e. requirements for site preparation, planting material, and/or submittal of a detailed replacement wetland construction plan)
3)	OOC includes specific instructions concerning wetlands replacement, and provisions requiring monitoring and/or maintenance of the replacement wetland.

5) Adjacent wetland and upland habitat types (i.e. forested wetland, shrub-scrub wetland, emergent wetland, upland forest, residential lot, commercial-industrial area).

6) Estimated size of the replacement wetland,if it appeared significantly smaller than specified in project plans.

7) An overall evaluation of the replacement wetland (see below) and (if applicable), the apparent reason(s) for failure. In instances were more than one replacement area was constructed for a single project, evaluations for the individual areas as well as the overall project were made.

Criteria used to evaluate the success of replacement wetlands are presented in Table 3. Evaluations were based primarily on criteria set forth in CMR 10.55 which require that replacement wetlands: 1) have 75 percent cover of indigenous wetland species, and 2) have a surface area equal to the area of the wetland lost.

The "conditionally successful" category was established to allow evaluation of newly built wetlands which may not have had adequate time to develop sufficient wetland cover.

Table 3. Criteria Used to Evaluate Replacement Wetlands

Category	Criteria
Fully Successful	areas with at least 75 % cover of indigenous wetland species; and a surface area equal to or exceeding the 1:1 replacement criteria specified in 310 CMR 10.55
Conditionally Successful	areas without 75 % wetland cover, but with sufficient size to meet 1:1 replacement criteria; and adequate conditions (grade, soils, ect.) to insure likely development of at least 75 % wetland cover
Marginal	areas with marginal size; and/or marginal conditions that may, or may not, eventually support 75 % wetland cover
Unsuccessful	areas lacking 75 % wetland cover or the necessary conditions to insure future development of adequate wetland cover; and/or areas of insufficient size to meet 1:1 replacement criteria

STUDY RESULTS

Seventy-six of the 100 projects selected for study had been completed, or were well underway. A total of 108 replacement wetlands were planned at these locations. Field studies found that 94 of these wetlands were in existence. Six of the remaining areas had apparently not been built, and four were under construction. Four replacement wetlands appeared to have been built, but were completely destroyed by subsequent filling. Further analysis of study results is presented below. Data for individual replacement wetlands is provided in Appendix C.

GENERAL ATTRIBUTES OF REPLACEMENT WETLANDS

Project plans called for replacement wetlands ranging in size from about 500 to 92,000 square feet (1 acre = 43,560 square feet). About 70 percent of the proposed replacement areas were less than 5,000 square feet in size (Figure 1). Most plans called for 1:1 (or nearly 1:1) replacement of filled areas.

Approximately 70 percent of the replacement areas were contiguous with preexisting wetlands. About 15 percent were detention basins, and essentially isolated from other wetland habitats. The remaining areas were contiguous with upland habitats, but hydrologically connected to preexisting wetlands via permanent or seasonal streams.

Among those replacement areas adjacent to preexisting wetlands, about 80 percent were contiguous with forested wetlands dominated by red maple. About 10 percent of the areas were contiguous with scrub-shrub wetlands, and the remainder with emergent wetlands.

About 60 percent of the replacement wetlands were situated on, or immediately adjacent to, residential lots. About ten percent were in close proximity to commercial or industrial properties.

During the study (late July to early August) approximately 60 percent of the replacement wetlands had standing water (Figure 2). In most instances, however, less than 50 percent of the surface area was flooded.

Figure 1: Size Distribution of Replacement Wetlands

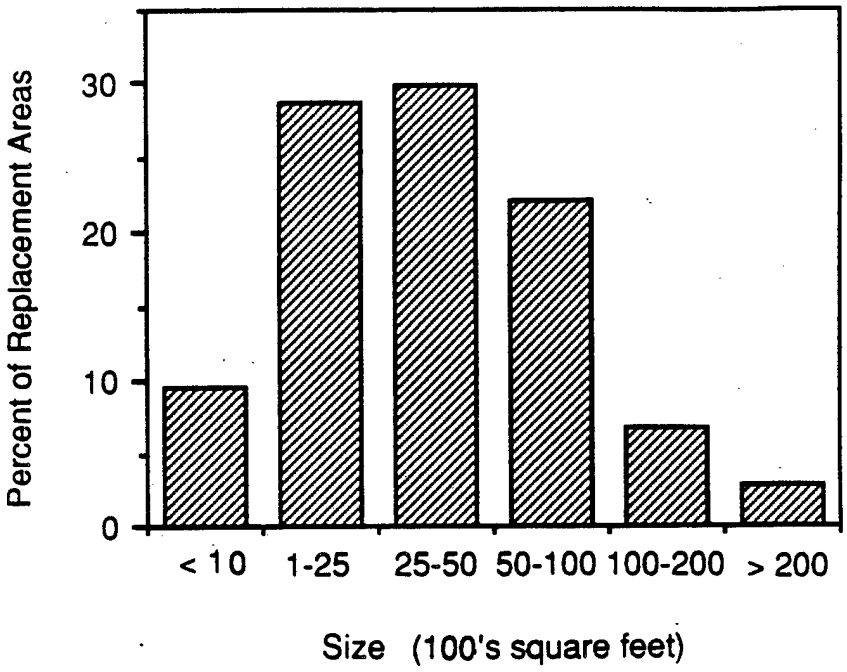
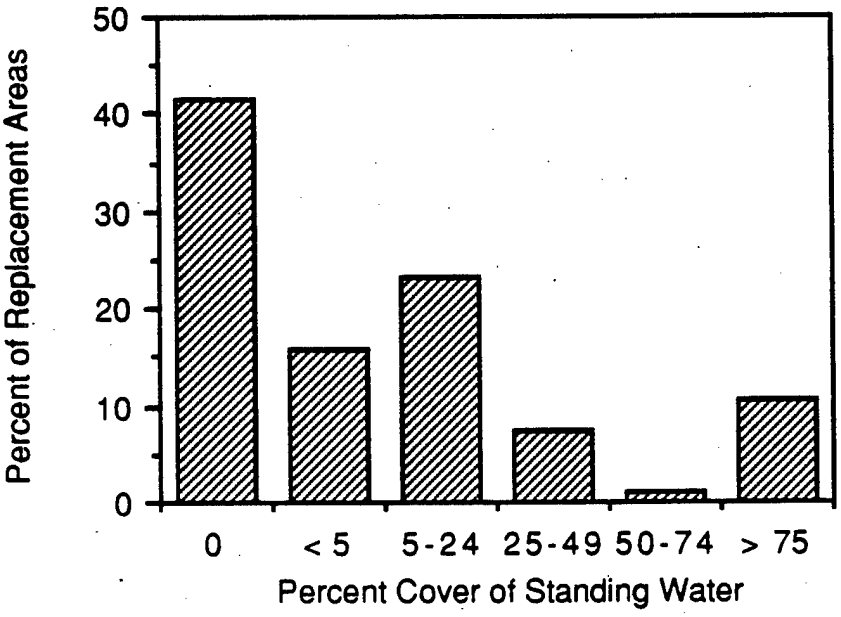


Figure 2: Standing Water in Replacement Wetlands



VEGETATION OCCURRING IN REPLACEMENT WETLANDS

Data concerning the vegetation present in replacement wetlands is summarized in Figures 3, 4, and 5. Overall, percent cover by wetland species was greater than 75 percent (the minimum performance standard in 310 CMR 10.55) in about 50 percent of the replacement wetlands. Many of the areas with less than 75 percent wetland cover, were less than two years old, and appeared likely to eventually support adequate wetland vegetation. Among replacement areas probably constructed prior to the fall of the 1986, about 75 percent had wetland cover greater than 75 percent.

Herbaceous species were predominant in virtually all the replacement areas. Commonly encountered wetland indicators included soft rush (Juncus effusus), sedges (Carex tribuloides and Carex lurida), cattail (Typha spp.), spike rush (Eleocharis spp.), woolgrass (Scirpus cyperinus), other rushes (Juncus spp.), purple loosestrife (Lythrum salicaria), boneset (Eupatorium perfoliatum), sensitive fern (Onoclea sensibilis), and cinnamon fern (Osmunda cinnamomea).

Coverage by wetland trees and shrubs was generally less than five percent, and exceeded 25 percent at only one site (a successful scrub-shrub wetland in Eastham). Commonly encountered woody wetland indicator species included red maple (Acer rubrum), sweet pepperbush (Clethera alnifolia), and highbush blueberry (Vaccinium corymbosum). Red maple seedlings were noted in about 40 percent of the replacement areas. Survivorship of shrubs and small trees transplanted from adjacent wetland areas generally appeared poor. Survivorship of nursery stock appeared excellent at several sites.

Figure 3: Vegetation Occurring in Replacement Wetlands (all sites, n = 94)

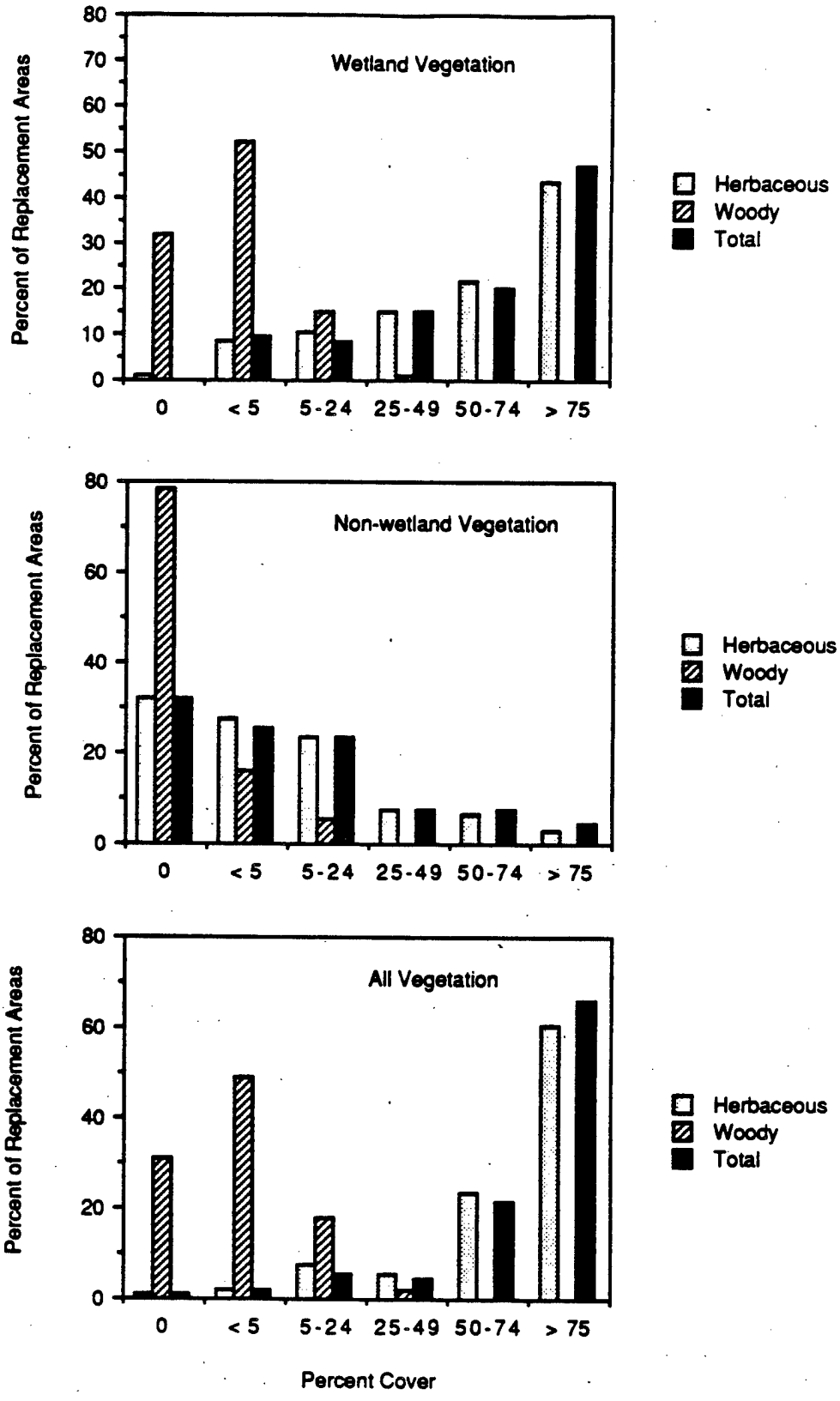


Figure 4: Vegetation Occurring in Replacement Wetlands Established After the Summer of 1986 (n = 69)

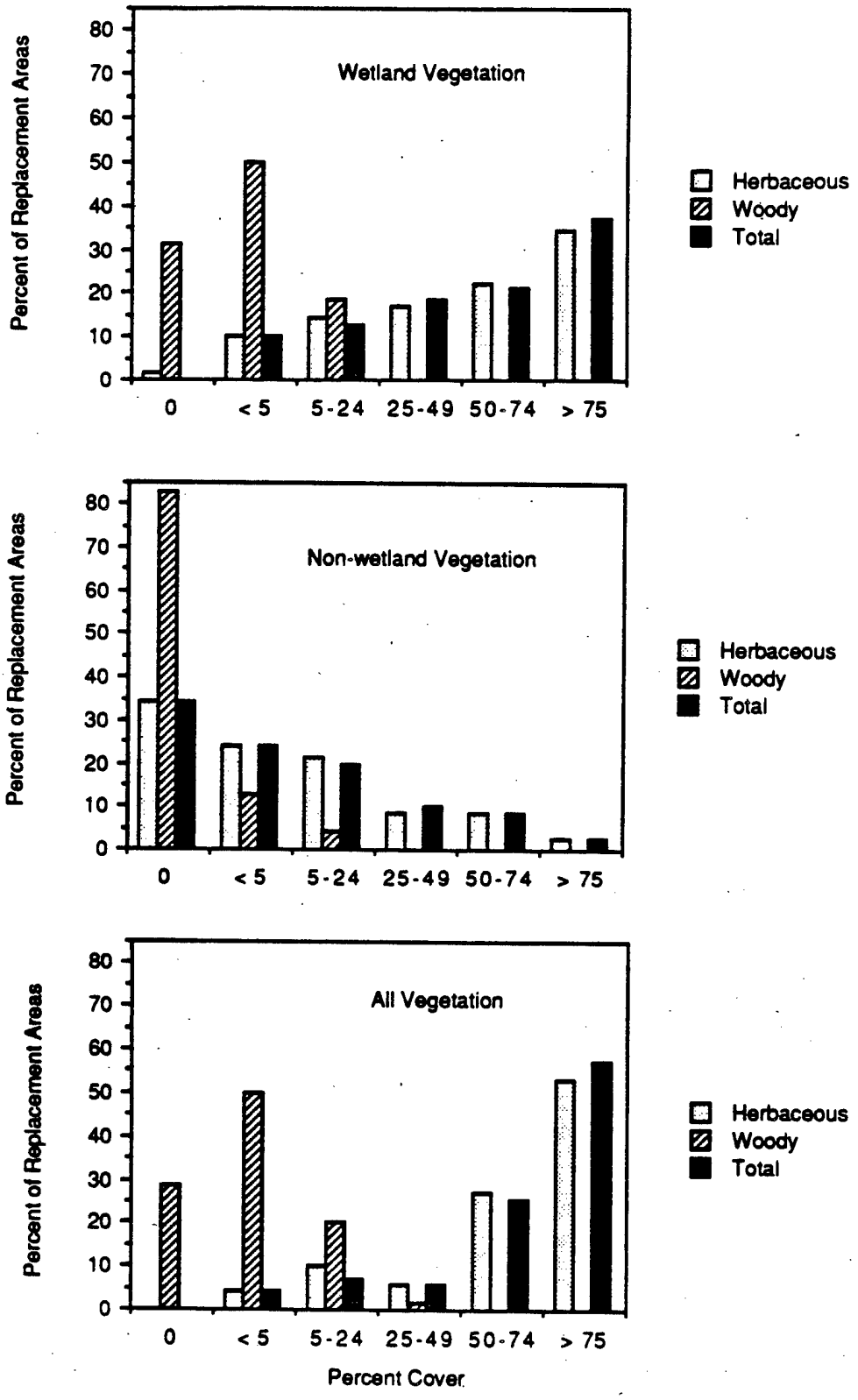
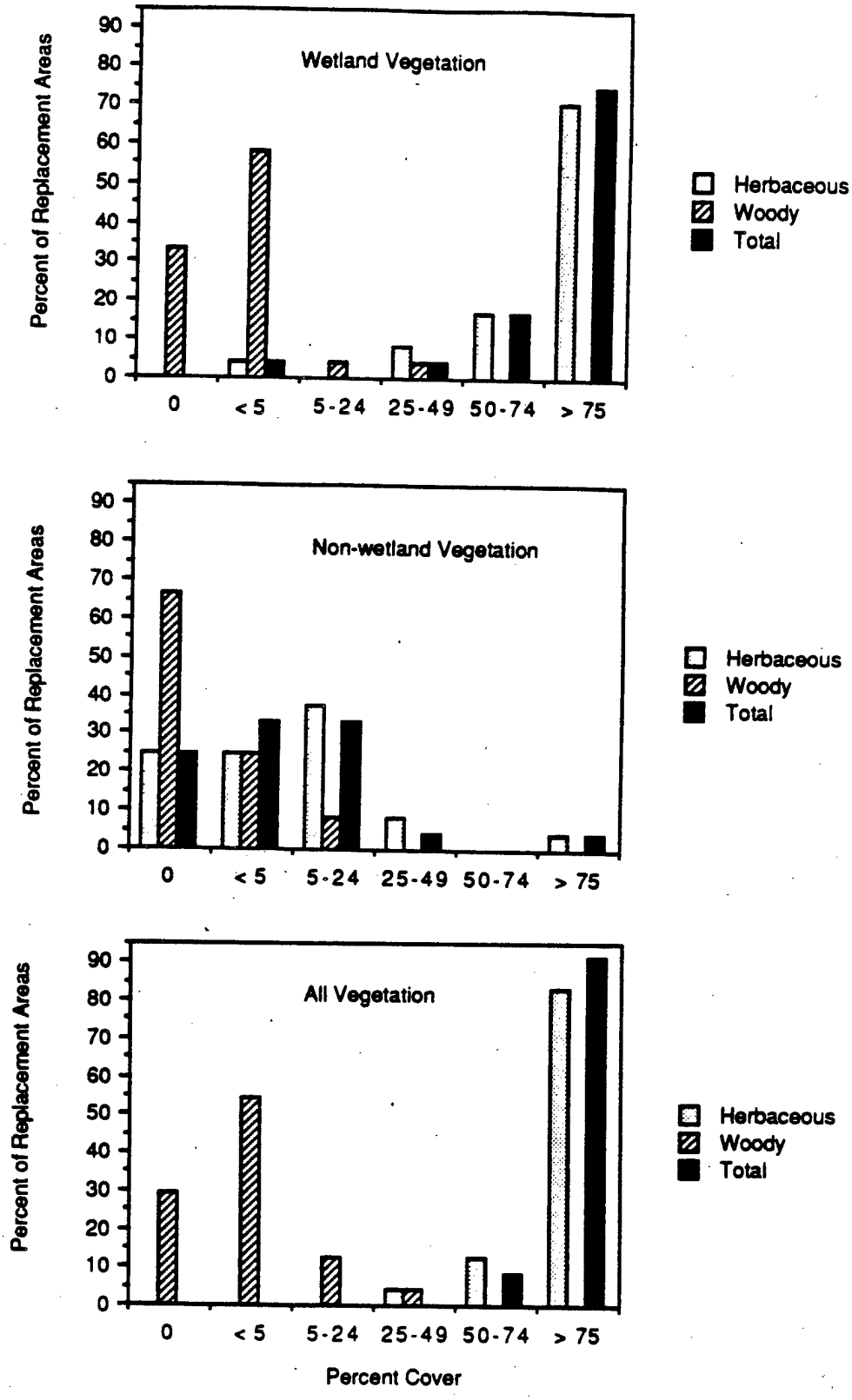


Figure 5: Vegetation Occurring in Replacement Wetlands Established Prior to the Fall of 1986 (n = 25)



EVALUATION OF REPLACEMENT WETLANDS

An evaluation of completed wetland replacement areas based on criteria developed for this study (see Table 3) is presented in Figure 6. Fifty seven percent of the 94 existing replacement areas were rated as fully successful or conditionally successful. Thirty-six percent of the sites were unsuccessful, and in need of remedial engineering work. The remaining sites were marginal.

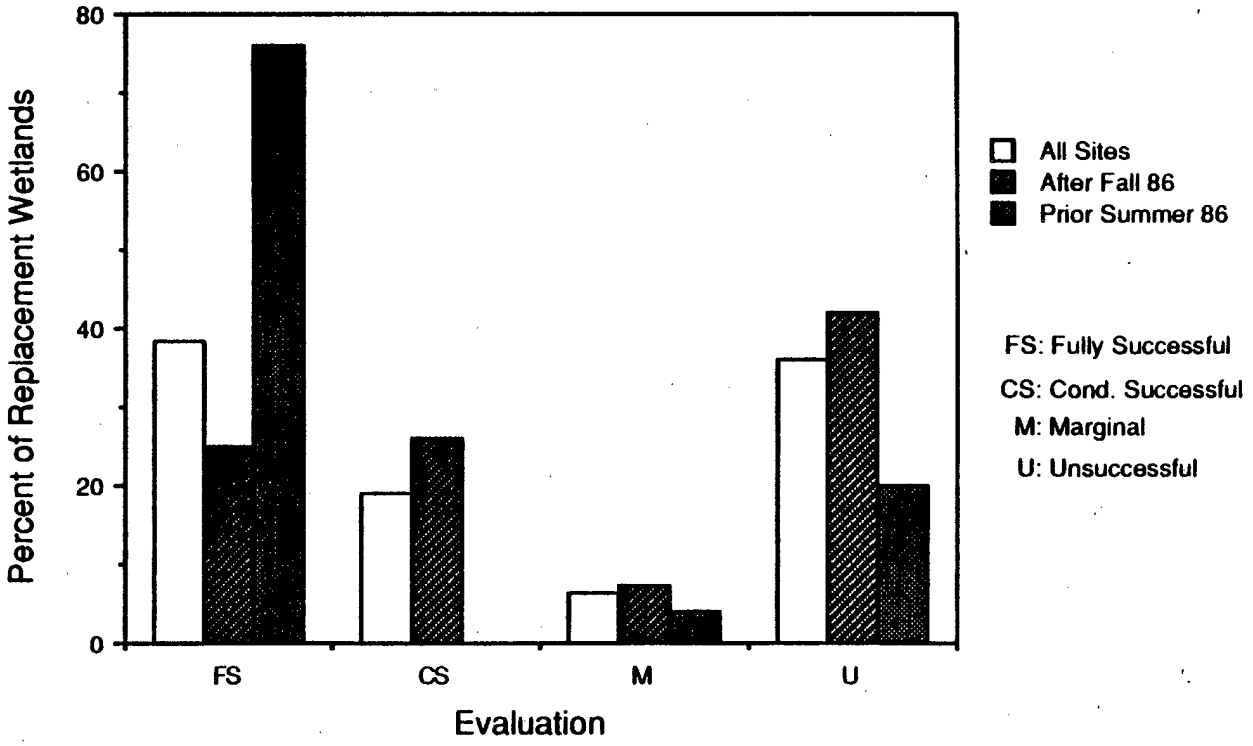
Among replacement wetlands probably constructed prior to the fall of the 1986, 76 percent were successful. About 50 percent of those probably constructed after the summer of 1986 were fully or conditionally successful.

Virtually all unsuccessful sites appeared to have failed because of inadequate site preparation. In about 50 percent of unsuccessful replacement areas, finished elevations were too high, resulting in a predominance of facultative or obligate upland plant species. About ten percent of the failed sites were excavated too deeply, resulting in ponds that supported only a narrow fringe of emergent vegetation. About 50 percent of the unsuccessful replacement areas were of insufficient size to meet 1:1 replacement criteria. In many instances sites appeared to be too small because plans failed to allow for area taken by the side slopes of the replacement wetlands. Relatively small replacement wetlands were more likely to fail for this reason than larger sites. About 15 percent of unsuccessful sites failed because of both inadequate grade and insufficient size.

Approximately 10 percent of replacement wetlands required at completed projects had not been built, or had been destroyed by fill material. These include four instances where there was no evidence that the replacement wetland had been built. In two cases field observations and interviews with land-owners strongly suggest that areas deemed "replacement" wetlands were probably preexisting wetlands. In four instances replacement wetlands had apparently been completely destroyed by fill material. Lesser amounts of fill material was noted in eleven other replacement wetlands.

Thirty one projects had been granted a Certificate of Compliance (COC). One or more existing replacement wetland was found to be unsuccessful in ten of these projects. In three additional projects, replacement wetlands had apparently been destroyed by fill material after the COC was granted. In some cases where unsuccessful projects were granted a COC, Conservation Commissions appeared satisfied by the fact that applicants had made a "good faith effort" to comply with Wetlands Protection Act regulations. In several other cases, Commissions appeared resigned to the situation, and had declined to expend further resources to force remedial action.

Figure 6: Evaluation of Replacement Wetlands



INFLUENCE OF PLAN QUALITY AND ORDERS OF CONDITIONS ON PROJECT SUCCESS

An attempt was made to correlate the success of replacement wetlands with the general quality of project plans and the strength of the Order of Conditions. Criteria employed to classify replications plans and Orders of Conditions are presented in Table 2. Projects which were unsuccessful because of post construction filling of replacement wetlands were excluded from this analysis.

Projects with plans that provided information as to how the replacement wetland was to be constructed had a somewhat higher success rate than those without any detailed plans (Figure 8). Chi-square analysis indicated, however, that the effect of plan quality on project success rate was not statistically significant ($p > 0.05$).

Replications with very good (Level 3) plans were typically unsuccessful because of insufficient size. This was in strong contrast to projects with weak (Level 1) plans which typically failed because of improper grade.

In several instances in which projects with excellent replacement plans were unsuccessful, plans were evidently not followed by the applicant and/or the construction contractor.

The most promising attempts to replicate red maple wetlands were based on detailed plans prepared by professional wetlands consultants.

Projects with strong (Level 3) Orders of Conditions containing provisions for monitoring had a somewhat higher success rate than projects with weaker conditions (Figure 7). As above however, chi-square analysis indicated that this effect was not statistically significant.

Figure 7: Influence of Orders of Conditions on Project Success

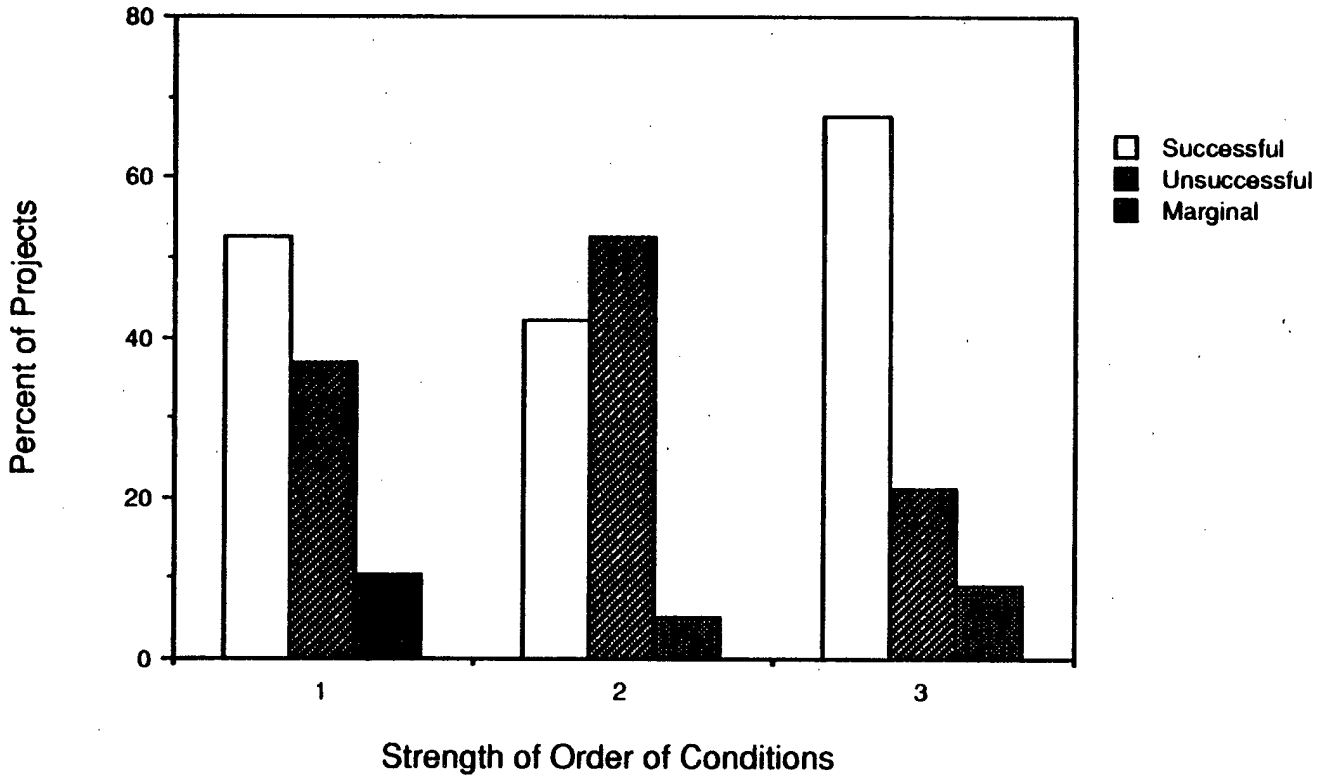
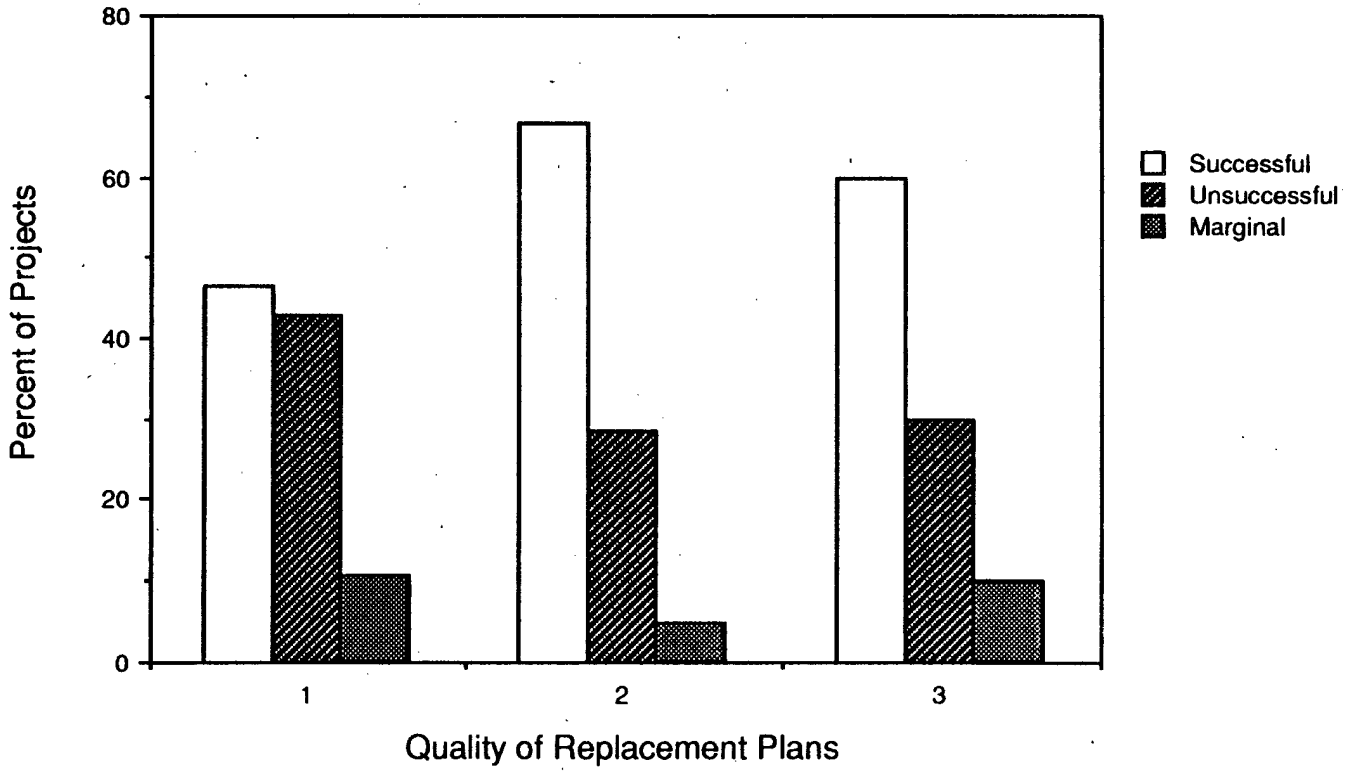


Figure 8: Influence of Replacement Plan Quality on Project Success



DISCUSSION

Results of this study indicate that attempts to replace freshwater wetlands in Massachusetts have had mixed success. Only about 60 percent of the areas evaluated, met, or are likely to meet, minimal criteria concerning vegetative cover and wetland size. Although remedial action at unsuccessful sites may improve the success rate, about one third of replacement projects already granted a Certificate of Compliance were found to be unsuccessful.

Furthermore, there is reason to doubt that many of the replacement areas rated as successful in this study function in a manner "similar" to the wetlands that were lost, as required under Wetlands Protection Act regulations. Virtually all the successful replacement wetlands were marshes or wet meadows dominated by emergent macrophytes (i.e. sedges, rushes, aquatic grasses, cattails). These wetlands may have substantially different functions relative to the filled wetlands, about 75 percent of which were dominated by trees (principally red maple) or shrubs. In particular, the replacement wetlands appear likely to provide substantially different wildlife habitat values than the lost wetlands. Functions such as flood control, groundwater recharge, and sediment retention may also vary between replacement and filled wetlands.

Most unsuccessful replacement areas were failures because site preparation work resulted in inadequate size and/or improper grade. In many instances replacement wetlands appeared to be of insufficient size mainly because plans did not account for area lost to side slopes. In future projects, the Orders of Conditions should explicitly require that the basal area of replacement wetlands be of sufficient size to meet the 1:1 replacement criteria. Size of replacement areas should be verified by the regulating authority prior to placement of wetland soils and planting of vegetation.

It should be possible to greatly reduce the number of projects which fail due to improper grade. Success rates should be high when replacement wetlands are built contiguous with existing wetlands, and the elevation of the existing wetland is used as a reference point. Construction of isolated wetlands should be avoided, in part, because it appears much more difficult to determine proper grade at these sites. Replication plans should clearly specify the desired grade, and qualified personnel should be on hand to monitor site preparation work. The grade of replacement wetlands should be inspected by Conservation Commissions and a qualified wetland replication specialist prior to placement of wetland soils and planting.

Given a proper grade and substrate, adequate herbaceous wetland vegetation is almost certain to develop in replacement wetlands. The widespread practice of transplanting 6 to 8 inches of soil from filled areas generally provides an adequate substrate and propagules for establishing a diverse herbaceous community. When wetland soils are available, supplemental planting of rhizomes and/or a wetland seed mix does not appear necessary to achieve adequate vegetative cover, but may speed development of the wetland community. Planting of rhizomes is desirable in cases where seed germination may be inhibited by flooded conditions. In instances where wetland soils are not available, planting of a wetland seed mix and/or transplants is required.

This study provided no clear evidence that forested or scrub-shrub wetlands can be successfully replaced. More research needs to be devoted to developing a protocol for establishing these types of wetland communities. Field observations in this study suggest that trees and shrubs transplanted from existing wetlands have a poor survival rate. It may be necessary to supplement transplants on a routine basis with nursery stock. Ideally such stock should be procured from nurseries specializing in production of material specifically for wetland restoration or replication projects. Planting densities should be at least one shrub or tree per 50 to 100 square feet.

The presence of red maple seedlings in 40 percent of replacement wetlands is encouraging, and suggests that forested wetlands could develop at these sites within a reasonable period of time (i.e. perhaps less than 100 years). Further studies need to be conducted to monitor the survivorship and growth of red maple seedlings in replacement wetlands.

Although sound horticultural practices would probably increase the survival of transplanted trees and shrubs, such practices are rarely specified in Orders of Conditions or project plans. The following practices should be encouraged: 1) trees and shrubs should be transplanted in the fall or early spring, 2) efforts should be made to minimize disturbance to root systems, 3) where appropriate, depressions should be excavated around transplants to trap and retain moisture, 4) sites should be watered as required until vegetation becomes well established.

Quality control should be an integral component of wetland replacement plans. Applicants should be required to monitor the status of replacement wetlands, and be required to implement remedial action (i.e adjustment of grades, replacement of dead shrubs and trees) as required. Replacement areas should be frequently inspected by regulating authorities, especially during the site preparation phase.

Measures should be taken to insure that replacement wetlands are protected from illegal filling. Replacement areas immediately adjacent to homes and driveways appear particularly susceptible to filling with lawn clippings, leaves, and other debris. To minimize potential damage to replacement wetlands, project plans should avoid placement of wetlands on or near residential lots. In small projects, where this may not be feasible, applicants should be encouraged to situate replacement wetlands as far removed from homes and driveways as possible.

SUGGESTED CONDITIONS FOR WETLAND REPLACEMENT PROJECTS

The following special conditions are suggested for inclusion in the Order of Conditions issued by Town Conservation Commissions for projects requiring replacement of bordering vegetated wetlands. In instances where detailed replacement plans are provided in project plans by the applicant, many of these conditions could probably be excluded from the Order of Conditions. This list was developed from a review of actual Orders of Conditions issued by various towns, plans from successful projects evaluated in this study, a set of generic conditions developed by the Wilmington, Massachusetts Conservation Commission, and replication guidelines developed by the Massachusetts Department of Environmental Protection (see M.S.M.C.P., 1988).

1. Prior to construction of the proposed project a detailed wetland replacement plan and narrative shall be submitted to the conservation commission for approval. The plan shall include, at a minimum, the following information:

a. A detailed description of the size, soils, hydrology and vegetation of the wetland to be filled. Information concerning vegetation should include a list of plant species present and their relative abundance, overall percent cover of wetland and upland species, and percent cover of vegetation strata (herbaceous, shrubs, overstory). Information concerning the existing vegetation at the proposed wetland replacement area should also be included.

b. A proposed construction time table and sequence.

c. Location, configuration, and grade of the proposed replication area(s) (including relationship to existing wetlands and the wetland area(s) to be filled).

d. Soils to be used in the replacement wetland.

e. Plant material to be transplanted or seeded, and the proposed planting density.

f. Measures to be taken to promote survival of transplanted material.

g. A monitoring plan and timetable for submittal of progress reports to the regulating authority.

h. Provisions for additional measures to be undertaken if the replacement wetland fails to meet performance standards after two full growing seasons.

2. A preconstruction on-site meeting should be held with the project engineer, wetlands specialist, construction supervisor, and Conservation Commission to insure that all parties understand the nature of the proposed work.

3. A copy of the replacement plan should be kept on site by the construction supervisor at all times.

4. Where feasible, the replacement area should be excavated to base elevation as stipulated in project plans prior to filling of any wetland. This work should be approved by the Conservation Commission prior to transplantation of wetland soils and plant material from the wetland area to be filled.

5. Transplanted wetland soils should be spread in a uniform manner over the replacement area to a depth of not less than 6-8 inches. If required, supplemental soils should be mixed with wetland soils to provide sufficient soil volume. Any soil supplements used shall be approved by the Conservation Commission.

6. Shrubs, trees, and herbaceous vegetation should be transplanted from filled areas. Plant material should be stockpiled for a minimal amount of time. Stockpiled material should be watered, and otherwise protected against desiccation and overheating.

7. Where possible, work should be conducted during the spring or fall to maximize survivorship of transplanted wetland vegetation.

8. Stock from a reputable nursery specializing in production of material for wetlands replacement and restoration projects should be used to supplement plant material transplanted from the filled wetland.

9. In order to establish a wetland similar to the lost wetland the following indigenous wetland species should be planted: (list predominant herbaceous and woody species present in the wetland to be filled, with consideration given to availability of plant material).

10. The planting densities of shrubs and trees should be (specify density) per 100 square feet.

11. Periodic progress reports detailing the vegetation present in the replacement wetland shall be forwarded to the Conservation Commission (reports at the end of each growing season until compliance is granted are suggested). At a minimum, the reports should include a list of species present at the site, their relative abundance, percent cover of wetland and non wetland vegetation, and the survival rate of transplanted shrubs and trees.

12. Remedial action to insure development of adequate indigenous wetland vegetation may be required by the regulating authority, if adequate vegetation is not present in the replacement wetland at the end of two full growing seasons.

13. A performance bond shall be posted prior to start of construction (as allowed by local wetlands bylaws).

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APPENDIX A

Massachusetts Wetlands Protection Act General Performance Standards for Replacement of Bordering Vegetated Wetlands

(from 310 CMR 10.55)

1. the surface area of the replacement area to be created ("the replacement area") shall be equal to that of the area that will be lost ("the lost area")

2. the ground water and surface elevation of the replacement area shall be approximately equal to that of the lost area

3. the overall horizontal configuration and location of the replacement area with respect to the bank shall be similar to that of the lost area

4. the replacement area shall have an unrestricted hydraulic connection to the same water body or waterway associated with the lost area

5. the replacement area shall be located within the same general area of the water body or reach of the waterway as the lost area

6. at least 75 percent of the surface of the replacement area shall be reestablished with indigenous wetland plant species within two growing seasons, and prior to said vegetative reestablishment any exposed soil in the replacement area shall be temporarily stabilized to prevent erosion in accordance with standard U.S. Soil Conservation Service methods

7. the replacement area shall be provided in a manner which is consistent with all other General Performance Standards for each resource area in Part III of 310 CMR 10.00.

APPENDIX B

Project Information Contained in the Tufts/MACC Wetland Replication Data Base

Legend to Tufts/MACC Wetland Replication Database

1. Town #

2. Town

3. Notice of Intent File Number

4. Size of Original Wetland (square feet)

5. Size of Replicated wetland (square feet)

6. Type of Original Wetland

no data = 0	wet meadow + swamp = 6
wet meadow = 1	bog + swamp = 7
marsh = 2	wet meadow + marsh = 8
bog = 3	wet meadow + marsh + swamp = 9
swamp = 4	other (introduced/exotic) = 10

7. Type of Replicated Wetland (see 6)

8. In kind/out of kind (plant community)

no data = 0	in kind = 1	out of kind = 2
in + species = 3	in - species = 4	in =/- species = 5

9. Activity

subdiv. lots/septic = 1	other = 6
subdivision roads = 2	no data = 7
private septic = 3	subdiv. road + lots/septic = 8
indust/commercial = 4	private driveway = 9
private (1-2 lots) = 5	

10. Regulations

10.53 (LP) = 1 10.55 (BVW) = 2 both = 3 violation = 4

11. Certificate of Compliance

issued = 1 not issued = 2 not issued but eligible = 3

12. Plants

no data = 0	stock/trans + nursery = 4
stockpiled/transplanted = 1	all = 5
nursery = 2	transplanted + seed = 6
seed bank = 3	nursery + seed = 7

13. Soils

no data = 0 stockpiled = 1 supplement = 2 both = 3

14. Performance Bond

no data = 0 yes = 1 no = 2

15. Superseding Orders of Conditions

yes = 1 no = 2

16. Orders of Conditions

no data = 0	good instruction = 3
weak = 1	strong w/monitoring = 4
standard (10.55) = 2	except. w/ monitoring + final = 5

17. Replication Plans

no data = 0	strong w/ monitoring = 4
little info = 1	exceptional = 5
perfor. standards = 2	none but required = 6
good w/ plant list = 3	

	Town	NOI	DATE OOC	Size Original	SIZE REP	TYPE ORIG	TYPE REPLIC	IN/OUT KIND	ACT	REGS	COC	PLANTS	SOILS	BOND	SOC	OOC	PLANS
REGION I																	
8	Braintree	226	Oct-86	2500	2500	4	4	1	2	1	2	4	1	2	2	3	4
8	Braintree	256	Mar-87	4690	4939	6	6	1	4	2	2	7	1	2	2		4
8	Braintree	188	Oct-85	8600	13900	4	4	4	2	1	1	7	1	1	1	3	3
21	Essex	151	May-88	2500	2500	4	0	0	9	1	2	0	0	2	1	3	1
21	Essex	145	Sep-87	4980	5100	4	4	1	5	1	2	4	1	2	2	2	3
125	Carlisle	179	Feb-86	1359	1481	1	1	1	9	1	2	0	0	2	2	1	1
125	Carlisle	173	Jan-86	2962	3077	4	4	4	2	1	2	2	1	1	2	3	4
125	Carlisle	192	Jun-86	4976	6318	4	0	0	2	1	2	0	0	2	2	1	0
125	Carlisle	189	May-86	37000	37000	4	0	0	2	1	2	0	0	2	2	1	0
203	Lincoln	57	Mar-86	50000	50000					1					1	4	
225	Millis	44	May-85	780	2500	4	4	1	1	2	1	0	0	2	1	1	0
225	Millis	52	Jul-85	3700	4000	4	4	1	3	2	1	1	1	2	2	2	1
225	Millis	75	Jun-86	4750	4950	4	4	1	4	2	2	1	1	2	2	3	2
225	Millis	71	May-87	3500	5000	4	4	1	4	2	2	3	3	2	2	2	2
225	Millis	50	Apr-85	4990	5355	4	4	1	1	2	1	1	1	2	2	2	1
225	Millis	76	Jul-87	5500	5500	5	5	4	4	2	2	2	1	2	2	3	3
242	N. Andover	413	Jun-87	588	1028	4	0	0	2	1	2	0	0	1	2	4	1
242	N. Andover	386	Mar-87	2500	2700	4	0	0	5	2	2	0	1	1	2	3	1
242	N. Andover	262	Jul-87	2850	3000	4	4	3	2	1	2	0	0	2	2	3	4
242	N. Andover	385	Apr-87	5280	5280	4	4	4	2	1	2	2	1	1	2	3	3
242	N. Andover	331	Mar-86	1620	6620	0	0	0	2	3	2	0	0	1	2	4	0
242	N. Andover	243	Nov-84	4630	6680	4	4	3	4	1	3	1	1	1	2	2	2
242	N. Andover	360	Apr-87	7200	7200	5	5	4	1	1	2	2	1	1	2	3	4
242	N. Andover	379	Dec-86	13500	13500	0	9	2	2	2	2	2	2	1	2	3	1
242	N. Andover	242	Oct-84	50000	50000												
305	Tewksbury	316	Apr-88	2500	2500	4	4	1	4	2	2	4	1	2	2		5
324	Wellesley	98	Oct-83	280	440	6	6	1	4	2	1	1	1	2	2	3	4
344	Wilmington	229	Jun-86	470	700	0	0	0	1	2	2	1	1	2	2	3	2
344	Wilmington	244	Mar-87	1340	1370	0	0	0	3	2	2	1	1	2	1	5	2
344	Wilmington	230	Aug-86	1250	1600	4	4	1	3	2	1	1	1	2	2	3	2
344	Wilmington	283	Jan-88	2000	2000	5	5	3	2	2	2	4	1	2	2	5	5

	Town	NOI	DATE OOC	Size Original	SIZE REP	TYPE ORIG	TYPE REPLIC	IN/OUT KIND	ACT	REGS	COC	PLANTS	SOILS	BOND	SOC	OOC	PLANS
REGION I																	
344	Wilmington	166	Jun-85	1840	2060	4	4	3	3	2	3	5	1	2	2	2	2
344	Wilmington	168	Jan-85	1540	1760	4	4	1	3	2	1	1	1	2	2	3	2
344	Wilmington	250	Apr-87	2400	2400	0	0	0	2	2	2	0	0	2	2	5	2
344	Wilmington	161	Sep-84	1200	3300	4	0	0	6	2	3	0	0	2	2	2	2
344	Wilmington	174	Oct-85	3410	3410	4	4	1	1	2	1	1	1	2	2	3	2
344	Wilmington	276	Nov-87	3400	3800	4	4	1	2	1	2	1	1	2	2	5	5
344	Wilmington	211	May-86	4100	4100	4	4	1	8	3	2	1	1	2	2	3	2
344	Wilmington	242	Dec-86	4240	4400	0	0	0	4	1	2	1	1	2	2	4	2
344	Wilmington	234	Sep-86	4400	4650	4	4	1	2	1	2	1	3	2	2	4	4
344	Wilmington	212	Aug-86	5290	5100	4	4	1	2	1	1	2	1	2	2	3	3
344	Wilmington	235	Oct-86	4050	5300	0	0	0	4	1	2	1	1	2	2	4	2
344	Wilmington	251	Apr-87	5360	5500	0	0	1	2	1	2	1	1	2	2	5	2
344	Wilmington	272	Nov-87	1620	7070	5	5	1	4	2	2	1	1	2	2	5	3
344	Wilmington	120	Sept-83	2500	10600	9	9	1	4	2	1	1	1	2	2	2	1
REGION II																	
3	Barnstable	1593	Jul-87	1900	2100	4	4	1	2	2	2	2	1	1	2	5	4
3	Barnstable	994	Oct 87	3838	4800	4	4	1	8	1	1	4	1	2	1	5	4
19	Eastham	319	May-85	3000	3000	0	4	1	9	2	3	2	0	2	2	3	0
19	Eastham	335	Nov-85	1000	1000	0	4	0	5	2	3	4	1	2	2	3	0
41	Marion	295	Oct-87	750	750	0	0	0	9	1	2	0	0	2	2	2	0
41	Marion	304	Jan-88	1200	3300	4	4	1	2	1	2	1	1	1	2	4	4
68	Scituate	430	Jul-86	2000	2030	4	4	1	5	2	2	6	1	2	1	2	4
60	Rehoboth	176	Oct-86	5000	5000	9	0	0	9	1	2	0	1	2	2	3	0
118	Brockton	199	Dec-86	1613	1682	0	0	0	5	2	1	0	0	2	2	2	2
152	Easton	204	Jul-86	1225	1225	0	0	0	1	2	2	0	0	2	2	3	6
152	Easton	149	Jul-84	5000	5000	0	0	0	2	2	1	0	0	1	2	1	1
152	Easton	186	Sep-86	21400	22100												
175	Hanson	58	Nov-86	3700	5100	6	6	1	4	2	2	1	1	2	2	2	4
175	Hanson	57	Nov-86	5400	5400	0	0	0	2	1	2	0	0	2	2	3	6
175	Hanson	40	Apr.87	15398	19588	0	2	0	2	1	2	2	3	2	1	5	3
250	Norton	113	Oct-84	960	960	4	0	0	4	2	3	0	0	2	2	3	0
250	Norton	127	Dec-85	1600	1600	2	2	1	5	2	1	0	1	2	2	3	0
250	Norton	151	Jun-87	2500	2500	0	0	0	2	2	2	0	0	2	2	4	6
250	Norton	164	Oct-87	4850	5000	4	4	1	2	2	2	4	3	2	2	2	4
250	Norton	153	Oct-87	25735	26258	4	4	1	1	1	2	0	1	2	2	4	6
269	Raynham	81	Aug-87	3900	3900	0	0	0	2	2	2	0	1	2	2	5	0
269	Raynham	70	Jan-87	8000	8000	0	0	0	4	1	2	0	0	2	1	3	1
269	Raynham	64	Oct-86	8100	8100	4	4	1	4	1	2	1	2	2	2	1	3

	Town	NOI	DATE OOC	Size Original	SIZE REP	TYPE ORIG	TYPE REPLIC	IN/OUT KIND	ACT	REGS	COC	PLANTS	SOILS	BOND	SOC	OOC	PLANS
REGION III																	
92	Ashburnham	106	Jan-88	2000	2000	4	4	1	2	2	2	4	3	2	2	3	5
101	Barre	50	Oct-87	2500	2500	0	0	0	9	2	2	0	0	2	2	2	0
160	Gardner	81	Jun-87	3480	3480	9	9	1	2	2	2	7	1	2	2	4	4
177	Harvard	94	Dec-85	15100	15100	1	2	1	5	1	2	3	1	2	1	3	2
204	Littleton	111	Jun-87	1550	1990	5	5	4	4	2	2	0	0	2	2	4	6
204	Littleton	109	May-87	3550	3550	4	0	0	2	1	2	0	0	2	2	3	6
204	Littleton	104	Oct-86	4900	4900	0	4	0	4	2	2	2	1	2	2	3	4
204	Littleton	107	Apr-87	23160	36100	9	10	2	2	1	2	2	1	2	2	4	2
202	Littleton	102	Sep-86	4900	4900											4	1
223	Milford	231	Nov-87	960	1200	4	4	1	1	2	2	6	1	2	2	4	3
223	Milford	205	Apr-87	1950	2140	4	4	1	9	1	2	0	1	2	2	3	2
223	Milford	202	Mar-87	3700	3700	9	0	0	4	2	2	0	1	2	2	3	1
223	Milford	230	Nov-87	3690	3770	0	0	0	4	2	2	0	0	2	2	4	2
223	Milford	197	Dec-86	4980	5080	0	0	1	4	2	2	1	1	2	2	3	1
223	Milford	134	Aug-85	4900	5200	0	0	0	1	2	1	0	0	2	2	1	1
223	Milford	161	May-86	4800	6000	4	4	1	1	2	1	3	1	2	2	2	2
223	Milford	207	Apr-87	1570	6600	0	0	0	1	2	2	0	0	2	2	3	2
223	Milford	216	Aug-87	6380	6760	5	0	0	2	1	2		1	2	2	3	2
223	Milford	136	Aug-85	4800	6800	8	8	1	4	2	3	6	1	2	2	1	1
295	Sterling	91	Dec-87	6000	7000	4	4	3	2	1	2	2	1	2	2	3	3
349	Worcester	254	Sep-87	11680	11680	4	4	1	2	1	2	1	1	1	2	4	4
349	Worcester	160	Jul-85	1000	1400	0	0	0	1	2	3	0	0	1	2	1	0
REGION IV																	
104	Belchertown	129	Oct-86	1900	2190												
104	Belchertown	146	Nov-87	1903	2810											4	
104	Belchertown	58	May-85	4600	4600						1			1			
104	Belchertown	131	Jan-87	16600	16600							4	1				3
168	Greenfield	94	Jan-88	5266	6125	5	5	1	2	1	2	4	1	2	2	4	4
168	Greenfield	78	May-86	8156	8156	4	4	1	4	1	2	1	1	2	2	3	1
263	Pittsfield	131	Oct-86	3260	4726	5	5	1	2	1	1	4	1	2	2	4	5
263	Pittsfield	167	Jun-87	23375	23575	9	9	5	2	1	2	4	1	2	2	3	4
263	Pittsfield	97	May-85	90028	92092	6	6	1	6	1	3	0	1	2	2	2	1
343	Williamstown	117	Apr-84	2500	3300												

APPENDIX C

Study Database

Legend for Study Database

1. Town Number

2. Town

3. Notice of Intent File Number

4. Status

    1 = project built
    2 = project not built or in early stages
    3 = replicate under construction
    4 = project was a wetland restoration, not true replication

5. Site Code

6. Replicate Size in Plans

    *: size estimated in field
    x: size estimate based on blue line plans and total project area.

7. Replacement Area Age

    1 = probably established after summer of 1986
    2 = probably established prior to fall of 1986

8. Replication Plan Quality (see Table 2 for Criteria)

9. Strength of Order of Conditions (see Table 2 for Criteria)

10. Site Evaluation (see Table 3 for Criteria)

    1 = fully successful 2. conditionally successful
    3 = unsuccessful 4. marginal

11. Reasons for Failure

    1 = grade too low 2 = grade too high
    3 = insufficient size 4 = fill material
    5 = project built but replicate not built or not completed
    6 = replication area appeared to be a preexisting wetland

12. Project Evaluation (see # 10)

13. COC

    1 = issued 2 = not issued

14. Vegetation (% Cover)

    H: herbaceous; W: woody; T: total

    0 = 0 1 = < 5
    2 = 5 - 24 3 = 25 - 49
    4 = 50 - 74 5 = > 75

15. Fill (see # 14) 16. Standing Water (see # 14)

	TOWN	NOI	STATUS	SITE	SIZE	AGE	PLANS	OOC	SITE EVAL	RFF	PROJ EVAL	COC
REGION I												
8	Braintree	226	1	A	72300	1	3	3	2		2	2
8	Braintree	256	2									2
8	Braintree	188	1	A	3200	1	3	3	3	3	3	1
8	Braintree	188		B	7200	1			3	3		
8	Braintree	188		C	4000	1			3	3		
21	Essex	151	2									2
21	Essex	145	2									2
125	Carlisle	179	1	A	1481	1	1	1	4	2	4	2
125	Carlisle	173	1	A	12200	1	3	3	2		2	2
125	Carlisle	192	1	A	2834	1	1	1	4	3	1	2
125	Carlisle	192	1	B	6318	1			1			
125	Carlisle	189	1	A	*5000	1	1	1	3	2,3	3	2
125	Carlisle	189	1	B	*1500	1			3	2,3		
125	Carlisle	189	1	C	*5000	1			3	2		
125	Carlisle	189	3	D	*1500	1						
125	Carlisle	189	1	E	*1000	1			3	2		
203	Lincoln	57	1	A	*45000	1	2	3	1		1	2
203	Lincoln	57	1	B	*12500	1			1			
225	Millis	44	1	A	908	2	1	1	1		1	1
225	Millis	52	1	A	4000	1	3	1	1		1	1
225	Millis	75	3	A	4950	1	2	2				2
225	Millis	71	2									2
225	Millis	50	1	A	1339	2	1	1	3	6	3	1
225	Millis	50	1	B	1150	2			3	2,3		
225	Millis	50	1	C	1500	2			3	4		
225	Millis	50	1	D	1400	2			3	4		
225	Millis	76	3	A	5500	1	2	2				2
242	N. Andover	413	2									2
242	N. Andover	386	1	A	2700	1	1	2	3	2	3	2
242	N. Andover	262	1	A	3000	1	3	2	3	3	3	1
242	N. Andover	385	1	A	6208	1	2	2	3	3	3	2

	TOWN	NOI	SITE	VEGETATION (% COVER) Wetland H	W	T	Non-wetland H	W	T	Total H	W	T	FILL	WATER
REGION I														
8	Braintree	226	A	1	2	2	2	0	2	2	2	3	0	1
8	Braintree	256												
8	Braintree	188	A	5	1	5	1	0	0	5	1	5	2	2
8	Braintree	188	B	5	1	5	1	0	1	5	1	5	0	2
8	Braintree	188	C	5	2	5	2	0	2	5	2	5	1	1
21	Essex	151												
21	Essex	145												
125	Carlisle	179	A	4	1	4	2	0	2	5	2	5	0	0
125	Carlisle	173	A	4	1	4	1	0	1	4	1	4	0	2
125	Carlisle	192	A	4	0	4	3	0	3	5	0	5	0	0
125	Carlisle	192	B	5	1	5	1	0	1	5	1	5	0	2
125	Carlisle	189	A	3	2	3	3	2	3	4	2	4	0	0
125	Carlisle	189	B	2	1	3	3	1	3	3	3	5	0	0
125	Carlisle	189	C	2	0	2	0	0	0	2	0	2	0	0
125	Carlisle	189	D											
125	Carlisle	189	E	3	1	3	3	2	3	5	2	5	0	0
203	Lincoln	57	A	5	1	5	2	0	2	5	1	5	0	0
203	Lincoln	57	B	5	1	5	2	0	2	5	1	5	0	0
225	Millis	44	A	5	1	5	1	1	2	5	1	5	0	0
225	Millis	52	A	5	2	5	1	0	1	5	2	5	0	2
225	Millis	75	A											
225	Millis	71												
225	Millis	50	A											
225	Millis	50	B	4	1	4	2	2	2	4	2	5	1	0
225	Millis	50	C										5	
225	Millis	50	D										5	
225	Millis	76	A											
242	N. Andover	413												
242	N. Andover	386	A	1	1	1	5	0	5	5	1	5	0	0
242	N. Andover	262	A	5	1	5	1	0	1	5	1	5	0	1
242	N. Andover	385	A	2	1	3	2	1	2	4	1	4	0	0

	TOWN	NOI	STATUS	SITE	SIZE	AGE	PLANS	OOC	SITE EVAL	RFF	PROJ EVAL	COC
REGION I												
242	N. Andover	385	1	B	4000	1			2			
242	N. Andover	331	1	A	7000	2	1	3	4	2	4	2
242	N. Andover	243	1	A	6680	2	2	2	3	2	3	2
242	N. Andover	360	1	A	7200	1	3	2	3	2	3	1
242	N. Andover	379	1	A	13500	1	2	2	3	3	3	2
242	N. Andover	242	1	A	x5500	2	3	3	1		1	1
242	N. Andover	242	1	B	x6000	2			1			
242	N. Andover	242	1	D	x3600	2			1			
242	N. Andover	242	1	E	x6750	2			1			
242	N. Andover	242	1	F	x6750	2			1			
242	N. Andover	242	1	G	x2500	2			1			
305	Tewksbury	316	2									2
324	Wellesley	98	1	A	440	2	3	2	3	4	3	1
344	Wilmington	229	1	A	700	1	1	2	3	4	3	1
344	Wilmington	244	1	A	1370	1	1	2	3	4	3	2
344	Wilmington	230	1	A	1600	1	2	2	2		2	1
344	Wilmington	283	2			1						2
344	Wilmington	166	1	A	2060	2	3	3	1		1	2
344	Wilmington	168	1	A	1760	2	3	3	1		1	1
344	Wilmington	250	1	A	2400	1	1	3	2		2	1
344	Wilmington	161	2									2
344	Wilmington	174	1	A	4400	2	2	2	1		1	1
344	Wilmington	276	1	A	4650	1	3	3	2		2	2
344	Wilmington	211	2									2
344	Wilmington	242	1	A	5300	1	2	3	1		1	2
344	Wilmington	234	1	A	1600	1	2	0	2		2	2
344	Wilmington	212	1	A	5300	1	2	2	2		2	1
344	Wilmington	212	1	B	1600	1			2			
344	Wilmington	235	1	A	5300	1	2	3	3	1	3	2
344	Wilmington	251	1	A	5500	1	2	3	2		2	2
344	Wilmington	272	1	A	7070	1	2	3	1		1	2
344	Wilmington	120	1	A	10600	2	1	1	1		1	1

	TOWN	NOI	SITE	VEGETATION (% COVER) Wetland H	W	T	Non-wetland H	W	T	Total H	W	T	FILL	WATER
REGION I														
242	N. Andover	385	B	0	1	1	4	0	4	4	1	4	0	2
242	N. Andover	331	A	4	1	4	2	0	2	5	1	5	0	2
242	N. Andover	243	A	1	1	1	5	0	5	5	1	5	0	0
242	N. Andover	360	A	2	0	2	4	0	4	5	0	5	0	0
242	N. Andover	379	A	5	0	5	0	0	0	5	0	5	0	1
242	N. Andover	242	A	5	0	5	0	0	0	5	0	5	0	3
242	N. Andover	242	B	5	0	5	0	0	0	5	0	5	0	3
242	N. Andover	242	D	5	0	5	1	0	1	5	0	5	1	0
242	N. Andover	242	E	5	0	5	0	0	0	5	0	5	0	3
242	N. Andover	242	F	5	0	5	0	0	0	5	0	5	0	3
242	N. Andover	242	G	5	0	5	0	0	0	5	0	5	0	3
305	Tewksbury	316												
324	Wellesley	98	A										5	
344	Wilmington	229	A	3	1	3	2	0	2	4	1	4	3	0
344	Wilmington	244	A										5	
344	Wilmington	230	A	4	2	4	1	1	1	4	2	4	1	2
344	Wilmington	283												
344	Wilmington	166	A	5	3	5	1	0	1	5	3	5	1	0
344	Wilmington	168	A	5	1	5	1	1	1	5	1	5	0	0
344	Wilmington	250	A	4	0	4	1	0	1	4	0	4	0	3
344	Wilmington	161												
344	Wilmington	174	A	5	0	5	1	0	1	5	0	5	1	0
344	Wilmington	276	A	4	2	4	0	0	0	5	2	5	0	2
344	Wilmington	211												
344	Wilmington	242	A	5	1	5	0	0	0	5	1	5	0	1
344	Wilmington	234	A	4	0	4	1	0	1	4	1	4	1	0
344	Wilmington	212	A	4	1	4	2	0	2	4	1	4	0	1
344	Wilmington	212	B	2	1	2	3	0	3	4	0	4	0	1
344	Wilmington	235	A	2	1	2	0	0	0	2	1	2	1	5
344	Wilmington	251	A	3	2	3	2	0	2	4	2	4	0	0
344	Wilmington	272	A	5	1	5	0	0	0	5	1	5	0	2
344	Wilmington	120	A	5	1	5	1	0	1	5	1	5	0	1

	TOWN	NOI	STATUS	SITE	SIZE	AGE	PLANS	OOC	SITE EVAL	REF	PROJ EVAL	COC
REGION II												
3	Barnstable	1593	2									2
3	Barnstable	994	1	A	x700	1	3	3	1		3	1
3	Barnstable	994	1	B	x1400	1			3	3		
3	Barnstable	994	1	C	x1100	1			3	1,3		
3	Barnstable	994	1	D	x1600	1			3	3		
19	Eastham	319	1	A	3000	2	2	2	3	2	3	1
19	Eastham	335	1	A	1000	2	2	2	1		1	1
41	Marion	295	2									2
41	Marion	304	2									2
68	Scituate	430	1	A		1	3	1	3	5	3	2
68	Scituate	430	1	B	8100	1	3	1	3	2,3		
60	Rehoboth	176	1	A	5000	1	1	2	3	1	3	
118	Brockton	199	1	A	1682	1	1	1	4	3	4	1
152	Easton	204	2									2
152	Easton	149	1	A	5000	2	1	1	1			1
152	Easton	186	1	A	12500	1	1	3	1		1	1
152	Easton	186	1	B	16000	1			1		1	
175	Hanson	58	1	A	1800	1	3	3	1		4	1
175	Hanson	58	1	B	1800	1			3	5		
175	Hanson	58	1	C	1600	1			3	3		
175	Hanson	57	1	A	2200	1	1	2	1		3	2
175	Hanson	57	1	B	3200	1			3	1		
175	Hanson	40	2									2
250	Norton	113	1	A	960	2	1	2	1		1	2
250	Norton	127	1	A	1600	2	1	2	1		1	1
250	Norton	151	4									2
250	Norton	164	1	A	5000	1	3	1	2		2	2
250	Norton	153	2									2

	TOWN	NOI	SITE	VEGETATION (% COVER) Wetland H	W	T	Non-wetland H	W	T	Total H	W	T	FILL	WATER
REGION II														
3	Barnstable	1593												
3	Barnstable	994	A	5	1	5	0	0	0	5	1	5	0	1
3	Barnstable	994	B	4	1	4	1	1	1	4	1	4	0	0
3	Barnstable	994	C	2	1	2	0	0	0	2	1	2	0	1
3	Barnstable	994	D	3	1	3	0	0	0	3	1	3	0	2
19	Eastham	319	A	3	0	3	3	2	4	5	2	5	0	0
19	Eastham	335	A	3	3	5	2	0	2	3	3	5	0	0
41	Marion	295												
41	Marion	304												
68	Scituate	430	A											
68	Scituate	430	B	1	0	1	5	0	5	5	0	5	0	1
60	Rehoboth	176	A	1	0	1	0	0	0	1	0	1	0	5
118	Brockton	199	A	5	2	5	0	0	0	5	2	5	0	5
152	Easton	204												
152	Easton	149	A	5	1	5	1	0	0	5	1	5	0	2
152	Easton	186	A	5	1	5	0	0	0	5	1	5	0	5
152	Easton	186	B	4	2	5	0	0	0	4	2	5	0	5
175	Hanson	58	A	5	1	5	0	1	1	5	1	5	0	5
175	Hanson	58	B											
175	Hanson	58	C	5	2	5	0	0	0	5	2	5	0	0
175	Hanson	57	A	3	2	5	2	2	3	2	2	5	0	1
175	Hanson	57	B	1	0	0	1	0	0	0	1	0	0	5
175	Hanson	40												
250	Norton	113	A	5	1	5	2	0	2	5	1	5	0	0
250	Norton	127	A	5	1	5	2	0	2	5	1	5	1	3
250	Norton	151												
250	Norton	164	A	4	1	4	2	0	2	5	1	5	0	0
250	Norton	153												

	TOWN	NOI	STATUS	SITE	SIZE	AGE	PLANS	OOC	SITE EVAL	RFF	PROJ EVAL	COC
REGION II												
269	Raynham	81	1	A	3900	1	1	3	3	2	3	2
269	Raynham	70	2									2
269	Raynham	64	1	A	8100	1	2	1	2		2	2
REGION III												
92	Ashburnham	106	2									2
101	Barre	50	1	A	2500	1	1	1	3	3	3	2
160	Gardner	81	2									2
177	Harvard	94	2									2
204	Littleton	111	1	A	1990	1	0	3	3	2	3	1
204	Littleton	109	3	A	3550	1	3	3				2
204	Littleton	104	2									2
204	Littleton	107	2									2
202	Littleton	102	1	A	4900	1	2	3	1		1	
223	Milford	231	1	A	x800	1	2	3	3	2	3	2
223	Milford	231	1	B	x400	1			3	2		
223	Milford	205	1	A	2140	1	1	2	3	6	3	2
223	Milford	202	1	A	3700	1	1	2	3	2	3	1
223	Milford	230	1	A	300	1	1	3	2		2	2
223	Milford	197	1	A	2500	1	2	3	2		1	2
223	Milford	197	1	B	2500	1			1			
223	Milford	134	1	A	5200	2	1	1	1		1	1
223	Milford	161	1	A	6000	1	2	1	3	5	3	1
223	Milford	207	1	A	6600	1	1	3	2		2	1
223	Milford	216	2									2
223	Milford	136	1	A	x4800	2	1	1	3	2	3	1
223	Milford	136	1	B	x2000	2			3	2		
295	Sterling	91	1	A	7000	1	2	1	2		2	2
349	Worcester	254	1	A	4400	1	3	3	3	3	3	2
349	Worcester	254	1	B	6600	1			3	1		
349	Worcester	254	2	C	480							
349	Worcester	160	2									2

	TOWN	NOI	SITE	VEGETATION (% COVER) Wetland H	W	T	Non-wetland H	W	T	Total H	W	T	FILL	WATER
REGION II														
269	Raynham	81	A	3	1	3	3	1	3	4	1	4	0	1
269	Raynham	70												
269	Raynham	64	A	4	2	4	0	0	0	4	2	4	0	2
REGION III														
92	Ashburnham	106												
101	Barre	50	A	3	0	3	0	0	0	3	0	3	0	0
160	Gardner	81												
177	Harvard	94												
204	Littleton	111	A	2	0	2	4	0	4	5	0	5	0	0
204	Littleton	109	A											
204	Littleton	104												
204	Littleton	107												
202	Littleton	102	A	5	0	5	1	0	1	5	0	5	0	1
223	Milford	231	A	3	0	3	4	1	4	5	1	5	0	0
223	Milford	231	B	3	0	3	4	0	4	5	0	5	0	0
223	Milford	205	A											
223	Milford	202	A	2	0	2	4	0	4	5	0	5	0	2
223	Milford	230	A	3	0	3	0	0	0	3	0	3	0	5
223	Milford	197	A	4	1	4	0	1	1	5	1	5	0	4
223	Milford	197	B	5	0	5	0	0	0	5	0	5	0	2
223	Milford	134	A	5	1	5	0	1	1	5	1	5	0	2
223	Milford	161	A											
223	Milford	207	A	2	1	2	0	0	0	2	1	2	1	2
223	Milford	216												
223	Milford	136	A	4	1	4	1	1	1	4	1	4	0	0
223	Milford	136	B	4	1	4	2	1	2	4	1	4	0	0
295	Sterling	91	A	4	1	4	1	0	1	4	1	4	0	2
349	Worcester	254	A	4	0	4	0	0	0	4	0	4	0	2
349	Worcester	254	B	1	0	1	0	0	0	1	0	1	0	5
349	Worcester	254	C											
349	Worcester	160												

	TOWN	NOI	STATUS	SITE	SIZE	AGE	PLANS	OOC	SITE EVAL	REF	PROJ EVAL	COC
REGION IV												
104	Belchertown	129	1	A	2190	1	3	3	1		1	2
104	Belchertown	146	1	A	2810	1	3	3	1		1	2
104	Belchertown	58	1	A	4600	2	1	1	1		1	1
104	Belchertown	131	1	A	16600	1	3	3	3	3	4	2
104	Belchertown	131	1	B	6800	1			1			
104	Belchertown	131	1	C	7600	1			4	3		
168	Greenfield	94	1	A	6800	1	1	3	2		2	2
168	Greenfield	78	1	A	8156	1	2	3	3	5	3	2
263	Pittsfield	131	1	A	2476	1	3	3	2		2	1
263	Pittsfield	131	2	B	2250							
263	Pittsfield	167	1	A	23575	1	3	3	1		1	2
263	Pittsfield	97	1	A	92092	2	1	1	1		1	2
343	Williamstown	117	1	A	3300	2	1	3	1		1	2

TOWN	NOI	SITE	VEGETATION (% COVER) Wetland H	W	T	Non-wetland H	W	T	Total H	W	T	FILL	WATER
REGION IV													
104 Belchertown	129	A	5	1	5	1	0	1	5	1	5	0	0
104 Belchertown	146	A	5	1	5	1	0	1	5	1	5	0	0
104 Belchertown	58	A	5	1	5	2	1	2	5	1	5	0	0
104 Belchertown	131	A	5	0	0	1	0	1	5	0	5	0	0
104 Belchertown	131	B	5	0	5	2	0	2	5	0	5	0	1
104 Belchertown	131	C	5	1	5	0	0	0	5	1	5	0	0
168 Greenfield	94	A	4	1	4	2	0	2	4	1	4	0	1
168 Greenfield	78	A											
263 Pittsfield	131	A	3	1	3	1	0	1	4	1	4	0	2
263 Pittsfield	131	B											
263 Pittsfield	167	A	5	2	5	2	1	2	5	1	5	0	2
263 Pittsfield	97	A	5	0	5	1	0	1	5	0	5	0	2
343 Williamstown	117	A	5	1	5	0	0	0	5	1	5	0	5